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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/061,218	02/04/2002	Masao Someya	42261	2110

1609 7590 07/09/2004

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EXAMINER	
LISH, PETER J	

ART UNIT	PAPER NUMBER
1754	

DATE MAILED: 07/09/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/061,218	SOMEYA ET AL.	
	Examiner	Art Unit	
	Peter J Lish	1754	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 April 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *14-22,25,26 and 29-40* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *14-22, 25-26, and 29-40* is/are rejected.

7)☒ Claim(s) *31* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claim 31 is objected to because of the following informalities: Claim 31 is identical to claim 25. It is suggested that one of these identical claims be canceled.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 14-15, 20-22, 25-26, 29, 31, and 36-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. (US 6,514,113) in view of Dai et al. (US 6,401,526).

Lee et al. ('113) teaches a process for the growth of aligned carbon nanotubes over a substrate material. The substrate is prepared by coating a metal film of aluminum, etc, which has no catalytic ability for the growth of carbon nanotubes, on a ceramic substrate of silica, alumina, quartz, or glass. A catalytic metal film, such as that containing cobalt, nickel, or iron, is then formed on the coated substrate. The substrate is then contacted with a carbon source in a chemical vapor deposition process to grow aligned carbon nanotubes.

The step of loading the metallic catalyst is performed by a method of forming a thin film, such as a thermal deposition method or a sputtering method. Lee et al. does not explicitly teach the step of calcining the substrate before growing the aligned carbon nanotubes.

Dai et al. also teach a method of growing nanotubes by chemical vapor deposition over a catalytically active substrate. Dai et al. teach the formation of a thin film of catalyst using methods such as dipping or stamping the substrate with a solution containing the catalytic material. The solution contains a salt of the metallic catalyst material such as a chloride, sulfate, nitrate, or another suitable salt. After the thin film is formed, the substrate is calcined at a temperature between 400 and 700 °C in order to remove any solvent and to convert the catalyst precursor to the desired form of the catalyst. It would have been obvious to use the method of Dai et al., including the required calcination step, to form the thin film of catalyst in the process of Lee et al., as it is an equivalent method for forming a catalyst thin film suitable for growing carbon nanotubes.

Regarding claim 20, the catalytic metal particles of Lee et al. are preferably formed to have a size of 20-60 nm. Regarding claim 26, the aluminum layer is formed by a thermal deposition or sputtering method. Regarding claim 29, Official Notice is taken that silica and alumina are porous ceramic materials. Regarding claim 40, the chemical vapor deposition of Lee et al. is carried out at a temperature of between 450 and 1000 °C in the presence of a hydrocarbon gas, such as acetylene, ethylene, propylene, or methane gas.

Regarding claims 25 and 31, Lee et al. does not explicitly teach the process of heating the ceramic substrate to dry prior to the application of the aluminum film. However, it would have been obvious to one of ordinary skill at the time of invention to ensure that the ceramic substrate be dry in order to ensure the formation of a uniform and effective film.

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. in view of Dai et al. as applied above, and further in view of Ohki et al (US 6,545,396 B1).

Lee et al. teach a process for the production of aligned carbon nanotube films for an electron emission device. Lee et al. teach the use of a variety of substrates, including silica, alumina, and other ceramic materials. Lee et al. do not explicitly teach the use of a silica-alumina substrate. Ohki et al. teach a similar process for the production of aligned carbon nanotube films for electron emission devices. Ohki et al. teach the preferred use of a silica-alumina substrate as it has the ability to withstand damage from the high temperatures needed for nanotube growth. It would have been obvious to one of ordinary skill at the time of invention to use the silica-alumina substrate of Ohki et al. as the substrate of Lee et al. because it is a ceramic material with high heat endurance capability.

Claims 16-19 and 32-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. in view of Dai et al. as applied above, and further in view of Hafner et al. (US 2002/0112814 A1) and Alkaitis (US 4,244,938).

Lee et al. and Dai et al. are applied above. Lee et al. teaches a process for the growth of aligned carbon nanotubes over a substrate material. Dai et al. teach the formation of a thin film of catalyst using methods such as dipping the substrate in a solution containing a salt of the metallic catalyst material such as a chloride, sulfate, nitrate, or another suitable salt. Neither Lee et al. nor Dai et al. teach the use of a hydroxide salt of the metal.

Hafner et al. also teach a process for the production of vertically aligned carbon nanotube films on substrates, wherein the step of loading the metallic catalyst is performed by a method of

forming a thin film, such as dipping the substrate into a solution comprising a metallic salt and an alcohol. Hafner teaches that hydroxides of the catalytic metal are suitable, as well as nitrates, sulfates, etc. It would have been obvious to one of ordinary skill at the time of invention to substitute a hydroxide salt solution of the metal catalyst, i.e. cobalt hydroxide, for the catalyst salt solution of Dai et al., as it is taught to be an equivalent and suitable salt regarding the application of a catalyst thin film by the dipping of a substrate.

Hafner et al. do not explicitly teach how the metal hydroxide salt is prepared. Alkaitis teaches that the preparation of transition metal hydroxides, such as cobalt hydroxide, by the addition of an alkaline, or basic, solution to an aqueous solution of a metal salt is known (see column 1). The salts listed by Alkaitis include chlorides, sulfates, nitrates, and acetates. Official Notice is taken that ammonia is basic. It would have been obvious to one of ordinary skill at the time of invention to use a catalytic metal hydroxide prepared by any known process, such as the well-known process described by Alkaitis, in the process of Hafner et al.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Peter J Lish whose telephone number is 571-272-1354. The examiner can normally be reached on 9:00-6:00 Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on 571-272-1358. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

-PL

STUART L. HENDRICKSON
PRIMARY EXAMINER